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SUGGESTED CROPPING SYSTEMS FOR THE BLACK LANDS OF TEXAS.

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SUGGESTED CROPPING SYSTEMS FOR THE BLACK LANDS OF TEXAS

INTRODUCTION.

The black-land region of Texas is one of the most productive and best developed agricultural sections of the Southwest, yet it presents some of the most difficult problems to be found in this country. The older portions have passed through a period of exploitive farming, during which cotton and grain were grown to the exclusion of crops which might have exerted a beneficial effect upon the soil. As in all rich, new sections, no effort was put forth to maintain fertility, because it was thought that the productiveness of the black heavy soils was practically inexhaustible. Eventually a marked decline was noted in the yields of all crops, and as land values rose [1]—owing to the increase in population—the conditions became such that only the most skillfully operated farms could be made to pay reasonable wages for labor performed and interest on the investment in land and equipment.

The main problem, therefore, and the one deserving immediate attention, is that of improving the soils and maintaining the farms in a high state of productiveness. This is made difficult by the prevalence of the disease known as root-rot (*Ozonium omniverum*), which attacks and materially injures crops, especially cotton and the legumes.

Cotton, the chief source of income, is damaged by this fungus to the extent of several millions of dollars annually.

The legumes have been grown only to a very limited extent, as there was not the same incentive during this period of exploitation to cultivate them against the attacks of the root-rot that there was in the case of cotton. Consequently, a system of farming developed on most farms in which legumes had no part. On the few farms where legumes are found, cowpeas and alfalfa are the most common. Cowpeas, however, are nearly always badly damaged by root-rot, while alfalfa is usually attacked the second or third year,[2] making

[1] During the last 40 years the price of black land has gradually risen from a few dollars to from $50 to $200 per acre, depending upon its desirability for farming purposes and its location.

[2] On the uplands southwest of Williamson County it is doubtful whether alfalfa should be included at all on account of the severe effects of root-rot; but on the alluvial bottom lands it is grown with profit. Its cultivation west of San Antonio depends largely on irrigation, a subject not discussed in this bulletin.

it necessary to plow up the field and plant to some crop not affected by this disease.

The general knowledge of the beneficial effect of leguminous crops on the land, strengthened by the local experience of increased yields resulting from turning under alfalfa, led to investigations which had for their object the control or extermination of root-rot, so that it might be possible to grow the legumes and establish types of farming which would restore the productiveness of the soil.

The first of these investigations, which have been continued to the present time, was undertaken about nine years ago by Dr. C. L. Shear, of this Bureau, and his assistant, Mr. George F. Miles. Though they tried every available means of eliminating root-rot without

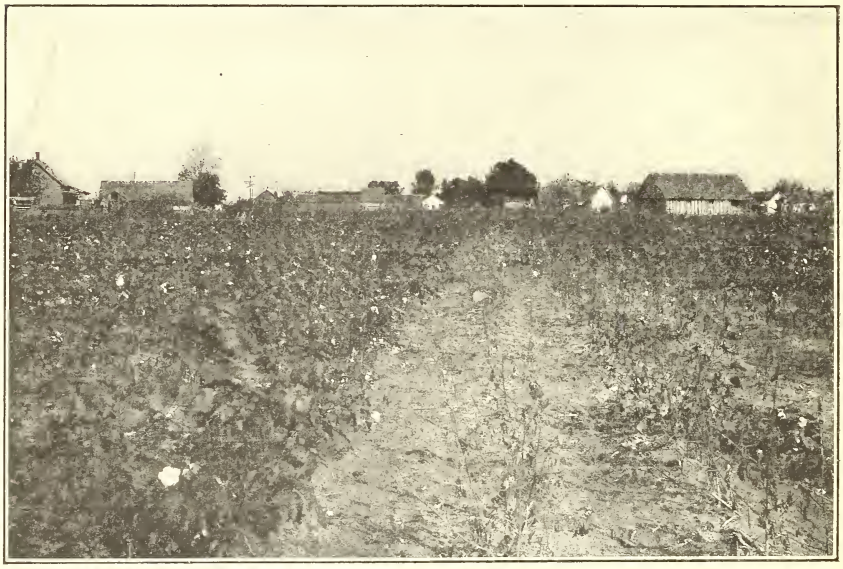

FIG. 1.—Experimental plats of cotton at Petty, Tex., showing the results of deep fall plowing. Plat A, at the left, was plowed 7 to 9 inches deep on November 12, 1906. Only 26.79 per cent of those plants were dead on November 11, 1907, and most of these had matured their crop. Plat B, at the right, received ordinary spring plowing. Of these plants, 69.54 per cent were dead on November 11, 1907, and these had died so early that they matured but a small part of their crop.

success, they found that deep fall plowing (fig. 1), applications of barnyard manure, and the rotation of grain crops with cotton in a large measure controlled the disease.

These facts, together with knowledge of certain farm practices which developed of necessity under root-rot conditions, furnish a basis for the establishment of rotations in which the well-known crops of this region follow each other naturally. For example, being compelled to plow up his alfalfa, the farmer follows it with grain, usually corn or wheat. He knows from experience that cotton would not succeed, for the reason that it is just as susceptible to root-rot

as alfalfa. This fact suggests at once a rotation of alfalfa, grain crops, and cotton, so arranged as to alternate susceptible crops with those which appear to be immune.

This work has also shown the need of a greater variety of legumes which may be used under root-rot conditions. For this reason an extensive test of varieties is being made in cooperation with farmers in the black-land region.

DESCRIPTION OF THE BLACK-LAND REGION.

The black-land region comprises two parallel belts and numerous isolated areas of level to rolling prairie, aggregating between 13,000,000

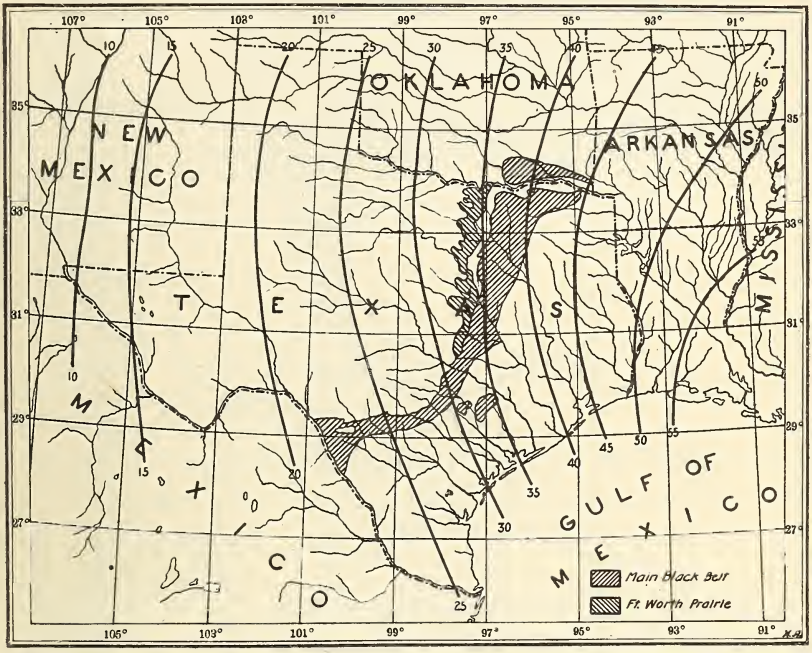

FIG. 2.—Location of the black lands, showing the average annual distribution of rainfall in the Southwest (based upon records of the United States Weather Bureau covering the period from 1871 to 1908, inclusive).

and 14,000,000 acres. The main black-land belt extends from the southern part of Oklahoma in a southwesterly direction across Texas. (Fig. 2.) It is about 550 miles long and varies in width from about 65 miles in northern Texas to about 25 miles in southwestern Texas. West of the main belt lies the Fort Worth prairie, an irregularly shaped, narrow belt extending from Red River to the vicinity of Round Rock, Tex. It is about 240 miles long and varies from 5 to 25 miles in width. The two belts are separated from Red River to the vicinity of Waco, Tex., by a narrow strip of sandy timbered country known as the east, or lower, cross timbers. Southwest of Waco the two areas lie contiguous and dovetail into each other.

Isolated areas, varying from a few acres to many sections in extent, are found west of the Fort Worth prairie in Somervell, Erath, Bosque, Comanche, Brown, Hamilton, Mills, Coryell, Lampasas, Bell, Burnet, Llano, and other western counties.

CLIMATE.

The climate is typically southern. The summers are long and hot, while the winters are mild, with the exception of a few "northers," which, because of their sudden appearance, are rather severe. The

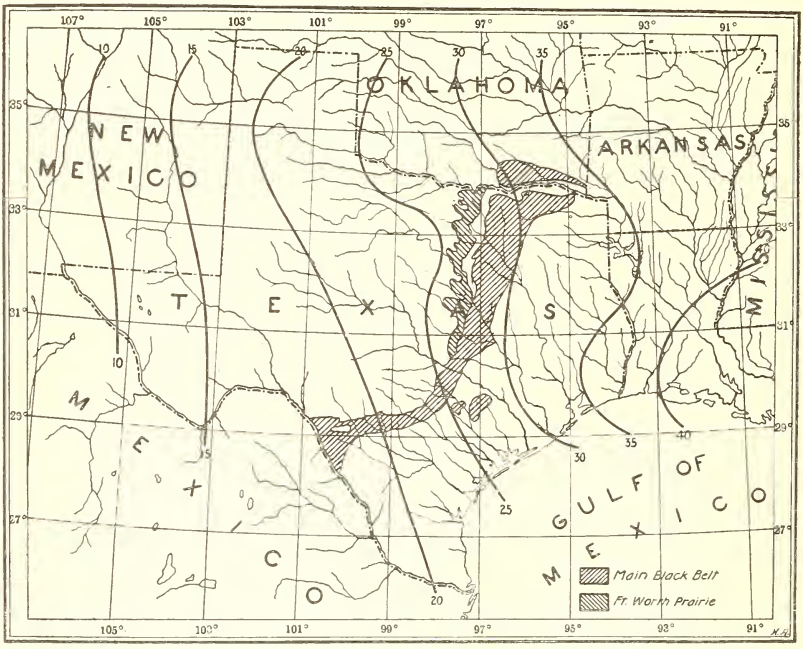

FIG. 3.—Location of the black lands, showing the precipitation during the crop-growing season (based upon records of the United States Weather Bureau covering the period from 1871 to 1908, inclusive).

belt extends from the humid region of northeastern Texas to the arid region in old Mexico. Wind velocities increase from an annual hourly velocity of 7 or 8 miles in the northeastern to 10 or 12 miles per hour at the southwestern end of the belt. The mean annual temperature at Paris, in the northeast, is 64° F.; at San Antonio, in the southwest, 69° F.

The usual crop-growing season extends from about February 1 to October 31, depending upon the latitude.

A close study of figures 2, 3, and 4 will greatly facilitate an understanding of farm problems in various parts of the black-land belt. It must be kept in mind, however, that a given amount of rainfall

in the Southwest is not as efficient in crop production as the same amount in the Central West or in the Eastern States, owing to the greater evaporation in the Southwest.

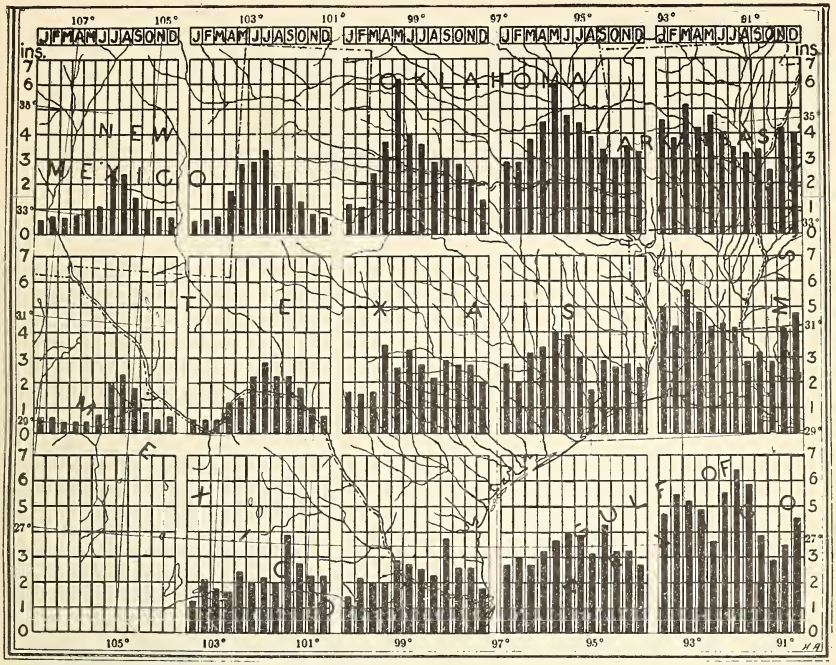

FIG. 4.—Graphical representation of the distribution of the average precipitation during the several months of the year in the Southwest at selected areas extending westward from the eastern to the western limits of the black-land region. The line of diagrams at the top of the figure shows the distribution over the territory extending west from the vicinity of Memphis, Tenn., through Little Rock, Ark., the vicinity of Oklahoma City, Okla., Amarillo, Tex., to Santa Fe, N. Mex. The middle line of diagrams shows the distribution over the territory extending west from the vicinity of Vicksburg, Miss., through Shreveport, La., and Fort Worth, Blanco, and El Paso, Tex. The bottom line of diagrams shows the distribution over the territory along the Gulf coast extending from the vicinity of New Orleans, La., through Galveston and Corpus Christi to Brownsville, Tex. (Data compiled by the United States Weather Bureau.)

The following dates showing the extreme and average occurrence of killing frosts (first in autumn and last in spring) in this region are compiled from the records of the United States Weather Bureau:

TABLE I.—*Extreme and average dates of killing frosts in the black-land region of Texas.*

Station and relative location in the region.	Average date.		Extreme date.	
	First in autumn.	Last in spring.	First in autumn.	Last in spring.
Paris (northern part)	Nov. 15	Mar. 28	Nov. 3	Apr. 12
Dallas (farther southwest)	...do.....	Mar. 26	...do.....	May 1
Waco (central part)	Nov. 10	Mar. 16	...do.....	Apr. 5
San Antonio (southwestern part)	Nov. 30	Feb. 25	Nov. 9	Mar. 19

SOILS.

The types of soil of the main black belt are derived from the underlying soft, chalky, or marly limestones, while those of the Fort Worth prairie and the more western isolated areas are derived from a harder and more impervious limestone which obviously is nearer the surface and more to be reckoned with in crop production than the soft limestone, which is more or less penetrable by water and the roots of plants. These soils are referred to as "black land," "black wax," "black waxy," "tallow ridge," "black prairie," "limestone," or "black sticky."

In their virgin state the black-land soils usually contain ample quantities of nitrogen, phosphoric acid, potash, lime, and organic matter, but after a few years of cultivation to grain and cotton the humus content becomes deficient and the soil assumes a poor physical condition, favoring the development of cotton root-rot and causing crops to suffer quickly from drought. The phosphoric-acid content becomes low in the loamy types of soil and the potash low in the stiff, black clays. Yet attempts to replenish these elements by the use of commercial fertilizers have resulted unsatisfactorily. The best results have been obtained from the use of barnyard manure and the plowing under of cowpeas and alfalfa. These experiences suggest that the immediate need of the black lands is organic matter. Formerly an abundance of lime was present in these soils, but now, owing to the cropping systems used, it has been found that applications of lime may profitably be made as a means of improving the physical condition of the heavier soils.

That the black-land soils are durable is very evident. The writer has visited a number of fields which have been cultivated continuously for 40 to 60 years and found them still producing fair crops of small grain, corn, and cotton. Compared with newer fields, however, a decline in the yields of these crops is perceptible. Abandoned farms in this region are rare.

HISTORICAL SKETCH OF THE BLACK-LAND REGION.

The occupation of Texas by white men began in 1820; but the black lands were utilized chiefly for hunting until along in the thirties. Farming began along the streams and in the sandy timbered region of east Texas, and the black lands were devoted chiefly to grazing until railroads were built and modern implements and barbed wire came into use. Their fertility, however, was recognized by some as early as the forties, and here and there a farm was opened upon which crops of corn, wheat, rye, and oats were grown. On the loams near the timber and on the alluvial soils along the streams crops of Irish and sweet potatoes were grown.

Though some cotton was produced in the black-land counties in the forties and fifties, it did not become an important crop until along in the sixties. Since then it has been the chief money crop, and the acreage has steadily increased. While it is more susceptible to root-rot than legumes, it has been successfully grown by shifting it from place to place on the farm. It is planted either in uninfested fields or after such crops as corn, wheat, or oats, which have been shown by experience to be immune to this disease. One farm was found upon which a definite 3-year mixed rotation, including wheat, oats, milo, corn, sorghum, and cotton, has been maintained for a third of a century. During this time no material loss has been sustained from root-rot, though it is present in all the fields.

Legumes have been grown to only a limited extent on the black soils. Census statistics show that though cowpeas have been grown to a limited extent in the black-land counties no material increase in their acreage has occurred since 1849. The acreage devoted to alfalfa is not large, because it does not have the permanency as a meadow that it assumes in other sections. It thrives usually from two to five years, then begins to die out in spots as a result of root-rot, and soon becomes unprofitable. Cowpeas and alfalfa being practically the only leguminous crops with which the farmers were familiar, they came to the erroneous conclusion that this class of crops could not be profitably grown, with the result that the legumes are by no means as extensively grown as their well-known value for grazing, hay, and soil-improvement purposes in other sections would seem to justify.

ROOT-ROT IN THE BLACK-LAND REGION.

The Texas root-rot is a fungous disease which attacks the roots of cotton, fruit trees, sweet and white potatoes, and, so far as known, all leguminous crops and many other cultivated plants. The grains and grasses are not affected by it. Apparently, its most favorable habitat is the heavy, black, waxy soils, especially those in poor physical condition. It is most conspicuous in fields that have been planted to cotton continuously or devoted to alfalfa for some time. It apparently becomes more destructive in its effects as the arid region is approached. That not all fields are infested with it is evident from the fact that here and there we find cotton fields and alfalfa meadows which show no signs of the disease. An alfalfa meadow on the stiff black upland, near Howe, Tex., said to be 11 years old, is still in perfect condition.

The disease is seldom found established in all the fields of any given farm. Usually it does not affect a cotton crop planted in a field which has been devoted to grain for two or three years imme-

diately preceding, but there is always the possibility of its reappearing at any time. How it spreads is not well known, but it is thought that it is carried from infested fields by winds, water, and farm implements.

Though there is no known method of exterminating this disease, its evil effects may be practically overcome by a proper rotation of crops, deep fall plowing, and the incorporation of organic matter into the soil, all of which are highly desirable practices for any black-land farm.[1]

SUITABLE ROTATIONS.

Few, if any, satisfactory rotations are practiced in the black lands of Texas. The uncertainty of the rainfall is a factor which often forces the farmer planning to practice a given rotation to quickly change his plans—as, for instance, when the land is prepared for alfalfa which, for lack of moisture, can not be sown. The farmer can not afford to let the land lie idle, so he substitutes some other crop which can be planted later in the season. Another reason why rotations are not more generally followed is the prevalence of root-rot.

The fact, however, that the farmer can not follow a rotation with the regularity of clockwork does not necessarily imply that he should not follow any rotation. On the contrary, he should plan a rotation that will improve the fertility of his soil, reduce root-rot, and otherwise satisfy his needs; but he should make it so flexible that it may be modified from time to time, as the conditions warrant, without detracting from the purposes which it is intended to accomplish.

THE BURNS ROTATION.

The most notable example that has come under the observation of the writer, illustrating how the agriculture of this region has developed without legumes, is found in the cropping system practiced by Mr. James Burns, of San Saba, Tex.

A definite rotation in which there is a total absence of legumes is rather unusual, if not altogether unique, in the history of southwestern agriculture. It becomes still more exceptional if it has been followed systematically for a long series of years; yet such a rotation has been practiced on one of the black-land farms whose history the writer has studied.

Thirty-two years ago this farm was divided into three equal fields (fig. 5) and the following 3-year mixed rotation was established, which has been maintained with consistency to the present time:

[1] Shear, C. L., and Miles, G. F. Texas Root-Rot of Cotton: Field Experiments in 1907. Circular 9, Bureau of Plant Industry, U. S. Dept. of Agriculture, 1908.

TABLE II.—*The 3-year mixed rotation in use on the Burns farm.*

30-acre tracts.	1908.	1909.	1910.
Field 1	Wheat..... 20 acres. Oats..... 10 acres.	Cotton..... 30 acres.	Corn..... 10 acres. Milo..... 10 acres. Sorghum..... 10 acres.
Field 2	Cotton..... 30 acres.	Corn..... 10 acres. Milo..... 10 acres. Sorghum..... 10 acres.	Wheat..... 20 acres. Oats..... 10 acres.
Field 3	Corn..... 10 acres. Milo..... 10 acres. Sorghum..... 10 acres.	Wheat..... 20 acres. Oats..... 10 acres.	Cotton..... 30 acres.

On this farm are kept 30 to 40 head of high-grade Shorthorn cattle, 10 to 15 Duroc-Jersey hogs, and 100 to 200 chickens. As soon as the crops are harvested the stock are turned in to glean the fields. The wheat and oats are grazed until about March 1, when

FIG. 5.—Bird's-eye view of the three fields on the Burns farm, where a 3-year mixed rotation has been in operation for 32 years.

the stock are taken off and the grain allowed to mature. In this manner everything produced is saved and sufficient manure has been added to the soil to maintain its fertility.

Owing to the limited rainfall, everything possible is done to conserve moisture.[1] After being broken as early as practicable in fall and winter the ground is kept stirred until planting time by the use of a disk and a steel-toothed harrow. All crops except wheat and oats are planted in rows and at rates of seeding which give stands about three-fourths as thick on the ground as is customary

[1] The records of the weather station located on this farm show that the annual rainfall for the period from 1901 to 1910, inclusive, has averaged 24.6 inches.

in a humid climate. Shallow cultivation (2 to 4 inches) is given as often as is necessary to maintain a mulch and keep down the grass and weeds throughout the growing period of the crops.

This rotation has enabled the owner to produce cotton with practically no loss from root-rot (though it is present in all his fields) and to produce sufficient crops from year to year, regardless of droughts, to meet his needs. He has so managed that it has not been necessary to buy hay, grain, lard, or bacon, and his cash income has been sufficient to meet all obligations incident to providing for and educating a family of 18 children.

The chief defect in his rotation is the absence of legumes. None have been used because in his early experience the owner was unsuccessful in growing cowpeas and other legumes which are commonly found in rotations, and he decided that it was useless to make further attempts. However, in contrast to most blackland farms, the need for legumes was met by a rigid rotation, including forage crops and the maintenance of enough stock to convert the roughage produced into manure, which was returned to the land. In this way the productiveness of the soil was maintained, while under the prevailing types of farming it gradually falls. In a later paragraph it will be shown that the owner of this farm is now testing several legumes which he plans to use in improving his cropping system.

ALFALFA IN SHORT ROTATION.[1]

The fact that alfalfa is naturally adapted to the black soils when unaffected by root-rot and that even when root-rot is present it remains one of the most profitable crops of the region for two or more years (fig. 6) led up to the idea that alfalfa could be grown profitably in short rotations with other crops. This was actually being done in a rather indifferent way by farmers who had been forced to plow up their alfalfa and follow with grain. In thus compelling farmers to plow up their meadows in two to five years root-rot in one respect has served a useful purpose. After the alfalfa has yielded hay in abundance for three or four years, they have followed it with corn, cotton, wheat, and oats and secured increased yields varying from 50 to more than 200 per cent.

On similar soils in the black belt of Alabama, William Munford planted alfalfa on land that produced an average of not over 18 bushels of corn per acre. When the meadow was two years old he plowed up and planted a part of it to corn, which yielded 45 bushels per acre, an increase of 150 per cent. Another portion of the same field was allowed to remain in alfalfa three years and then planted

[1] It should be noted that alfalfa to be successful, here as elsewhere, must be planted on land that is fairly rich in humus. The most successful farmers either give the land a good dressing of stable manure before planting or turn under a green crop of some kind.

to corn, which yielded 55 bushels per acre, an increase of 205.5 per cent.[1]

Many of the farmers visited know from experience that the fertility of the soil is better conserved if a new meadow is planted in another field whenever it becomes necessary to plow up the old one because of root-rot, but there was some confusion as to how to plan a rotation including alfalfa.

In order to make it perfectly plain to everyone, a suggested plan, based on successful practice in use on various black-land farms, is outlined in figure 7, showing how a 160-acre farm, 120 acres of

FIG. 6.—Cows grazing on an alfalfa meadow 5 years old near Cleburne, Tex. Root-rot is gradually reducing the size of the meadow.

which are in cultivation and divided into four 30-acre fields, would appear each year for a period of 12 years. This plan may be modified for any given farm as conditions justify without lessening its value.

It will be observed that the alfalfa remains 3 years [2] in each of the 4-year periods, and in the meantime a 3-year rotation of cotton or wheat, corn, and oats is in operation on the other three fields. For convenience wheat or oats occupy each field the year previous to its being planted to alfalfa or, if the soil is poor, cowpeas may be used in preference to either wheat or oats. In this rotation ample opportunity is afforded for controlling root-rot, as resistant crops occupy the land from two to three years between the alfalfa and the cotton.

[1] See "A Successful Alabama Diversification Farm," Farmers' Bulletin 310, U. S. Dept. of Agriculture, 1907.

[2] In cases where alfalfa is destroyed before the third year a short rotation of alfalfa, corn, cotton, and small grain may be used.

Where root-rot is exceptionally destructive, leguminous catch crops such as cowpeas and soy beans should be left out of the rotation until the disease is checked, but where it appears only on a plant here

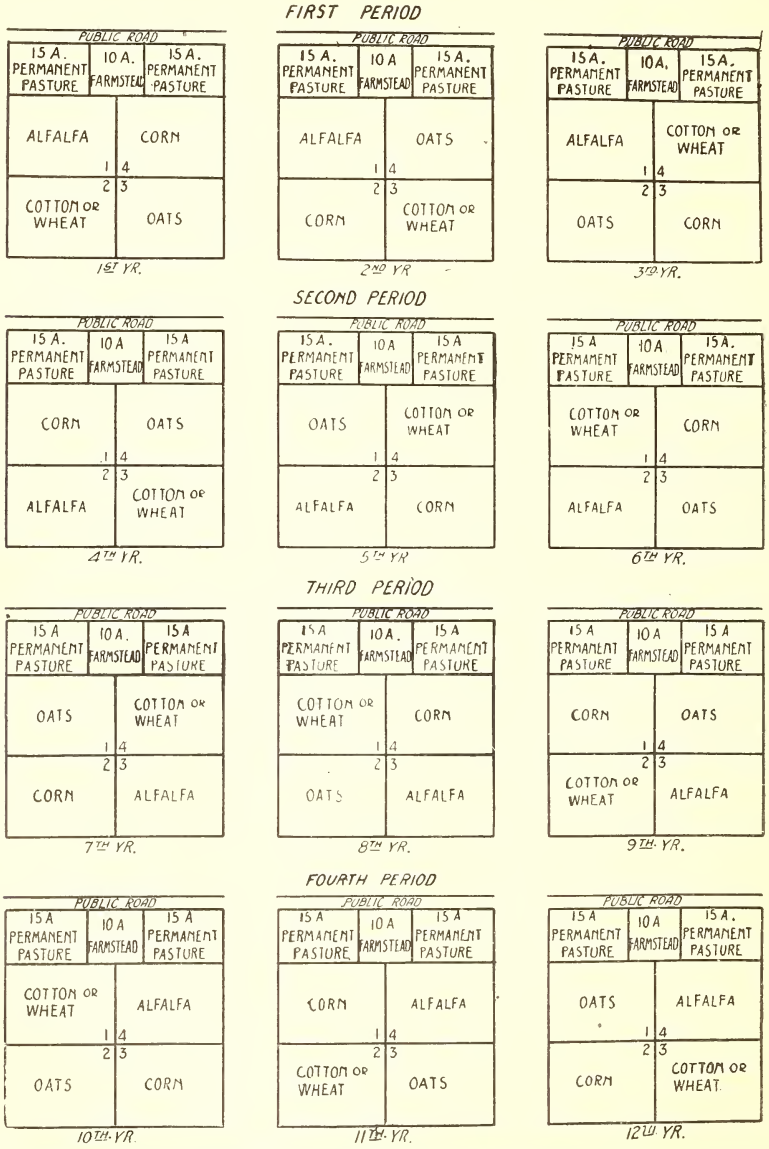

FIG. 7.—Appearance each year for 12 years of a 160-acre farm, 120 acres of which are devoted to four crops of 30 acres each, in rotation, viz, alfalfa, cotton or wheat, oats, and corn.

and there its effects will be more than compensated for by the benefits derived from these crops.

LEGUMES NOW BEING TESTED.

In 1909, owing to the general interest manifested in the establishment of better cropping systems, it was determined to find if possible whether or not legumes other than those heretofore tested could be used for the production of hay and green manure in rotation with the crops already established.

As up to this time Whippoorwill cowpeas were the only crop of this kind that had been tried to any considerable extent, it was thought that possibly some suitable varieties might be found among the many already in use in other sections or among those that had been introduced from other countries. To determine this question, the cooperation of the Office of Forage-Crop Investigations was enlisted, and a test of all available varieties of annual legumes was begun in the spring of 1910. Public-spirited farmers in various parts of the area entered heartily into the scheme and freely gave the use of their land and services to help solve this problem. Seed of about 25 varieties was obtained and distributed to 16 farmers to be planted and grown under the immediate direction of the writer.

From the beginning the farmers maintained an eager interest in the work, and so pleased were they with the results of last season's experiments that they have determined to incorporate some of the most promising varieties into their regular cropping systems. Though none of the legumes proved to be immune to root-rot, some of them were so slightly affected by it that their value for forage and as soil builders was hardly impaired.[1] Among these were certain varieties of soy beans and cowpeas. Sweet clover, Florida beggarweed, and guar [2] were also used. (Figs. 8, 9, 10, 11, 12, and 13.)

It has been found difficult to obtain a stand of sweet clover in most sections; its introduction should therefore be attended with some caution. Florida beggarweed is a new crop in this region; its introduction should also be attended with some caution.

The results of one season's work are by no means conclusive, but since the tests were made after many years of observation, study, and experience in growing cowpeas and alfalfa on a black-land farm, enough has been learned to show that under ordinary conditions alfalfa and other legumes may be grown for forage and soil-improvement purposes, if they are included in a properly planned rotation.

The tests will be continued until definite conclusions can be drawn as to which of the newly introduced varieties are the most satisfactory, and the conclusions will be published later by the Office of Forage-Crop Investigations. The results already attained indicate quite con-

[1] A single exception to this statement was on J. M. Campbell's farm near Richardson, Tex., where Iron and Brabham cowpeas and Mammoth soy beans were purposely planted on an old alfalfa meadow which had been destroyed by root-rot, the continued presence of the disease in the soil being well known. By the time the crops were ready to be cut for hay, about half of each variety had been destroyed by the disease.

[2] The value of this legume is as yet problematical, and further experiments will be necessary to determine its utility as a green manure or forage crop for this region.

clusively that there are several varieties which can be used in relieving the situation which has so far prevailed in the black-land region.

USE OF LEGUMES IN THE ROTATION.

As an example of how the annual legumes may be used in the cropping systems already established, let us refer again to the rotation in use on the Burns farm. The originator of this rotation was one of the first to begin a test of all available legumes under our direction.

FIG. 8.—Groit cowpeas grown in 1910 near Richardson, Tex., on heavy black-waxy soil. Root-rot was present, but the damage done was very slight.

Finding several that were very promising in so dry a season as 1910, he is giving them field trials in 1911 so that in 1912 he may select for his use those which suit him best and thereafter modify his rotation somewhat, as in Table III.

TABLE III.—*Proposed rotations, showing possible use of legumes in a cropping system.*

Tract.	1912.	1913.	1914.	1915.
Field 1.	Wheat..... 15 acres. Oats..... 7½ acres.	Legumes... 22½ acres.	Corn..... 10 acres. Milo..... 10 acres. Sorghum... 2½ acres.	Cotton..... 22½ acres.
Field 2.	Legumes... 22½ acres.	Corn..... 10 acres. Milo..... 10 acres. Sorghum... 2½ acres.	Cotton..... 22½ acres.	Wheat..... 15 acres. Oats..... 7½ acres.
Field 3.	Corn..... 10 acres. Milo..... 10 acres. Sorghum... 2½ acres.	Cotton..... 22½ acres.	Wheat..... 15 acres. Oats..... 7½ acres.	Legumes.... 22½ acres.
Field 4.	Cotton..... 22½ acres.	Wheat..... 15 acres. Oats..... 7½ acres.	Legumes... 22½ acres.	Corn..... 10 acres. Milo..... 10 acres. Sorghum.... 2½ acres.

These changes are expected to produce the money crops—wheat and cotton—on a smaller area, and the increased productiveness of

FIG. 9.—Brabham cowpeas grown near Hutchins, Tex., in 1910, on black land infested with root-rot.

FIG. 10.—Mammoth soy beans grown on black land near Cleburne, Tex., in 1910. They were sown in rows 3 feet apart and cultivated. They received practically no rain from planting to maturity. Root-rot was present, but did little damage.

the soils which it is thought will follow is depended upon to keep a larger number of live stock and thus materially enlarge the income.

In addition to having one field in legumes, as shown in the diagram, it is planned to grow cowpeas and soy beans in alternating rows with

FIG. 11.—Guar 3 to 5 feet high, grown in 1910 near San Saba, Tex., with practically no rain from planting, April 22, to maturity.

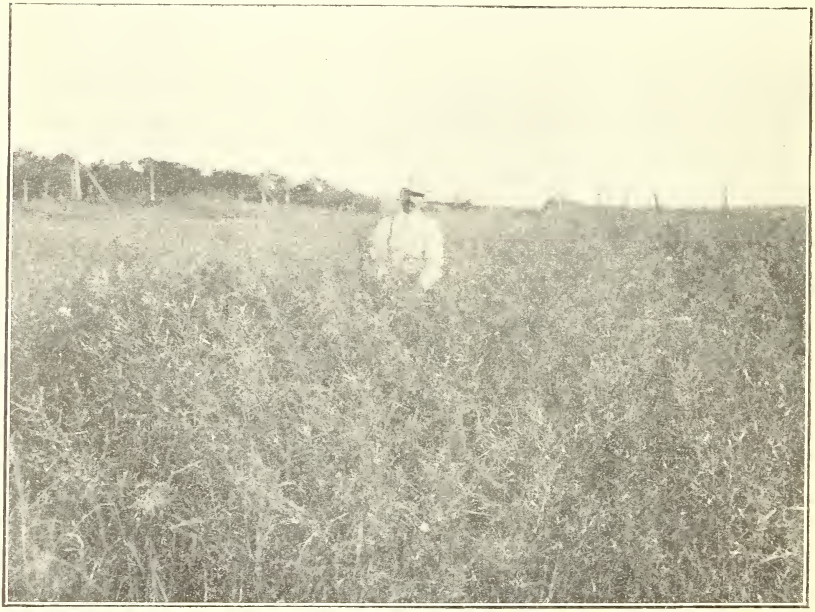

FIG. 12.—Sweet clover growing along a railway near Sherman, Tex. It is found growing wild in many places in the black lands between Red River and Temple, Tex.

corn, milo, and sorghum and to plant sweet clover with oats, cutting both for hay in case the clover is large enough when the oats are ready; but in case the sweet clover is too small, the oat crop will be

allowed to mature. In either event the sweet clover is expected to grow again and make either a crop of hay or some grazing before fall. After the wheat, such legumes as cowpeas, soy beans, beggarweed, and guar[1] will be planted in rows 2½ to 3 feet apart and so cultivated as to conserve moisture. The rainfall is so limited and uncertain that satisfactory results are seldom obtained from planting broadcast after grain or between the corn rows at the last cultivation.

MODIFICATION OF A ROTATION COMMON IN THE SOUTH.

A rotation tending to maintain fertility, in use in the more humid sections, is (1) corn with cowpeas planted between the rows at the last cultivation, (2) cotton,[2] and (3) oats followed by cowpeas sown broadcast. This rotation, omitting the cowpeas and often with the oats left out, is the one that has prevailed in the black lands from the beginning and that has brought about the decline in the productiveness of the soils. In fact, those who realized the advisability of including legumes in the rotation failed in their efforts to grow them because of the limited and uncertain rainfall more than from any other cause.

FIG. 13.—Florida beggarweed grown on the black land near Hutchins, Tex., in 1910. The plant shown in this figure was more than 7 feet tall. The beggarweed was planted in rows 3 feet apart and cultivated. The plat could have been cut twice for hay. A good crop of seed was produced.

In the last few years, however, many farmers have learned that they can grow cowpeas quite successfully by planting them in alternate rows with corn, or in rows after oats, and cultivating them as frequently as they would corn. Those who have tried this plan are well pleased with the results. They have not only produced a crop of cowpeas, but by planting the corn twice as thick in the row as ordinarily they have secured as good and in most instances better yields of corn than from similar areas of the same type of soil upon which

[1] Guar is mentioned on account of its promise as a soil builder. Its value as a forage crop in this country is doubtful.

[2] In many localities this rotation is modified by transposing the cotton and corn crops.

the corn was planted in the usual manner. Furthermore, in every instance a better quality of corn than the average was reported. With these modifications the rotation, corn and cowpeas, cotton, and oats followed by cowpeas, becomes applicable over the greater part of the black-land region.

SUMMARY.

(1) The farmers of the black-land region of Texas are seeking information relative to cropping systems which will increase and maintain soil fertility and make their farms more profitable.

(2) The price of black land has increased during the last 40 years from a very low price to prices ranging from $50 to $200 per acre.

(3) The original productiveness of much of the soil has been greatly lessened by (1) the presence of a plant disease known as root-rot, which is especially injurious to cotton and legumes, and (2) the consequent absence of legumes from the rotations.

(4) Though no practical remedy for Texas root-rot has yet been discovered, its evil effects may be largely overcome (1) by deep fall plowing, (2) by the rotation of resistant with nonresistant crops, and (3) by the incorporation of organic matter into the soil.

(5) Legumes generally are not as much affected by root-rot as is cotton. In a properly arranged rotation alfalfa and a number of varieties of cowpeas can be grown to great advantage. Tests under way indicate that several other legumes will prove to be of great service to the farmers either as hay or as soil improvers, notably certain varieties of soy beans.

(6) Alfalfa is killed by root-rot in two to five years, causing many farmers to decide that it is not a suitable crop for black lands. Experience, however, has proved that in many sections it pays to grow alfalfa in a short rotation with grain, allowing it to remain on a field about three years, or until destroyed by root-rot, and then plowing up the meadow and reseeding another, to remain a similar length of time.

(7) The yields of wheat, corn, oats, and cotton following alfalfa in rotation are materially increased.

(8) In a desirable cropping system for a black-land farm the Texas root-rot is overcome, legumes are grown, the fertility of the soil is increased and maintained, and the acreages of crops grown are so arranged that ample crops of each may be produced from year to year for the needs of the farm.

(9) The rotation should be planned in such a manner that it can be modified from time to time to meet changes in the weather and other unexpected conditions without detracting from its value.

(10) On most black-land farms a mixed rotation similar to the one used by James Burns is most satisfactory, as it enables one easily to adjust acreages of various crops.

(11) Cowpeas may be grown successfully on the black lands in the ordinary rotation of cotton, corn, and oats by planting them in alternate rows with the corn, or after the oats in rows, and cultivating them two or three times.

(12) The work thus far accomplished is but preliminary to a more extensive and detailed study of farm-management problems in the black-land belt. The legume tests will be continued as long as may be necessary in order to arrive at definite conclusions.

Approved:

JAMES WILSON,
Secretary of Agriculture.

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